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ABSTRACT

This learning activity packet (LAP) is one of three that accompany the curriculum guide on grinding machines. It outlines the study activities and performance tasks for the third unit of this curriculum guide. Its purpose is to aid the student in attaining a working knowledge of this area of training and in achieving a skilled or moderately skilled competency level in the performance of jobs associated with this specialty. The course of study in this LAP will help the student become able to set up and operate the cylindrical grinder; mount, balance, and dress a grinding wheel; grind work between centers; and regulate wheel speed, work speed, and rate of table travel. Seven tasks are included in the LAP. Contents are a check list of the learning steps, pretest, assignment sheets, and answer keys for the pretest and assignment sheets. (YLB)

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State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for GRINDING MACHINES

LAP NO. _____ CODE: _____

INSTRUCTIONAL UNIT UNIT III--CYLINDRICAL GRINDING

LEARNING ACTIVITY PACKET NO. 3

PREREQUISITE LAP(S) 2

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Cylindrical Grinding." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to set up and operate the cylindrical grinder; mount, balance, and dress a grinding wheel; grind work between centers; and regulate wheel speed, work speed, and rate of table travel.

TASKS INCLUDED IN THIS LAP:

1. Remove and replace a grinding wheel.
2. Use table-mounted holder to dress a grinding wheel.
3. Grind a workpiece straight and to size.
4. Grind a workpiece to dimension.
5. Grind a #4 Morse taper.
6. Grind an internal surface.
7. Grind an angular surface.

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User of LAP:

Included in this LAP are the answers to the pre-test and answers to the assignment sheets. If you desire to evaluate these two components, then it will be your responsibility to remove these components from the LAP prior to giving to the student. If you desire for the student to assume the responsibility for self-evaluation, then we would suggest that you leave the components contained as part of the LAP.

We hope this developmental design proves to be beneficial to you.

Sincerely,

Bob Patton, Coordinator
Curriculum and Instructional
Materials Center

BP:jd

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1.	Read	Unit and Specific Objectives, page GM-237.
_____ 2.	Complete	Cylindrical Grinding Pretest, LAP page 13.
_____ 3.	Study	The sections of the Information Sheet, pages GM-243 through 258, indicated by your instructor on your Pretest.
_____ 4.	Refer	To Step 11 of your Pretest. If additional study is indicated for any of Sections I, III through VIII, or X, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.
_____ 5.	Do	LAP Assignment Sheet #1, LAP page 25.
_____ 6.	Do	LAP Assignment Sheet #2, LAP page 37.
_____ 7.	Refer	To Step 11 of your Pretest. If additional study is indicated for Section II, continue to Learning Step 8. Otherwise, proceed to Learning Step 17.
_____ 8.	Do	Assignment Sheet #1--Identify Cylindrical Grinding Operations, pages GM-267 through 270.

_____ 9.	Stop.	Have your instructor evaluate Assignment Sheet #1. If your instructor is satisfied with your performance, proceed to Learning Step 11. Otherwise, continue to Learning Step 10.
_____10.	Do	LAP Assignment Sheet #3, LAP page 49.
_____11.	Do	Assignment Sheet #3--Plan Procedures for Grinding a Tapered Mandrel, pages GM-275 and 276.
_____12.	Stop.	Have your instructor evaluate Assignment Sheet #3. If your instructor is satisfied with your performance, proceed to Learning Step 14. Otherwise, continue to Learning Step 13.
_____13.	Do	LAP Assignment Sheet #4, LAP page 51.
_____14.	Do	Assignment Sheet #4, Plan Procedures for Grinding a Lathe Center, pages GM-277 and 278.
_____15.	Stop.	Have your instructor evaluate Assignment Sheet #4. If your instructor is satisfied with your performance, proceed to Learning Step 17. Otherwise, continue to Learning Step 16.
_____16.	Do	LAP Assignment Sheet #5, LAP page 55.
_____17.	Refer	To Step 11 of your Pretest. If additional study is indicated for Section IX, continue to Learning Step 18. Otherwise, proceed to Learning Step 21.
_____18.	Do	Assignment Sheet #2--Calculate Wheel Speed (rpm), Work Speed, and Rate of Table Travel (ipm), pages GM-271 through 274.

_____19. Stop. Have your instructor evaluate Assignment Sheet #2. If your instructor is satisfied with your performance, proceed to Learning Step 21. Otherwise, continue to Learning Step 20.

_____20. Do LAP Assignment Sheet #6, LAP page 57.

_____21. Check The tasks below that you feel you can perform without supervision.

Student Check		Instructor Initials/Date: Skilled	Moderately Skilled
_____	a. Remove and replace a grinding wheel (24)	_____	_____
_____	b. Use table-mounted holder to dress a grinding wheel (30)	_____	_____
_____	c. Grind a workpiece straight and to size (36)	_____	_____
_____	d. Grind a workpiece to dimension (42)	_____	_____
_____	e. Grind a #4 Morse taper (48)	_____	_____
_____	f. Grind an internal surface (54)	_____	_____
_____	g. Grind an angular surface (60)	_____	_____

_____22. Discuss Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 66. Otherwise, continue to Learning Step 23.

_____23. Refer To Learning Step 21a. If this task has been initialed by your instructor, proceed to Learning Step 29. Otherwise, continue to Learning Step 24.

_____24.	Study	Job Sheet #1--Remove and Replace a Grinding Wheel, pages GM-283 and 284.
_____25.	Watch	Slide/tape presentation, "Remove and Replace a Grinding Wheel" (GM-III-1).
_____26.	Do	Job Sheet #1--Remove and Replace a Grinding Wheel.
_____27.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21a, and proceed to Learning Step 29. Otherwise, repeat Learning Steps 24 through 26 and then continue to Learning Step 28.
_____28.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21a, and continue to Learning Step 29. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 21a, and continue to Learning Step 29.
_____29.	Refer	To Learning Step 21b. If this task has been initialed by your instructor, proceed to Learning Step 35. Otherwise, continue to Learning Step 30.
_____30.	Study	Job Sheet #2--Use Table-Mounted Holder to Dress a Grinding Wheel, pages GM-285 through GM-287.
_____31.	Watch	Slide/tape presentation, "Use Table-Mounted Holder to Dress a Grinding Wheel" (GM-III-2).
_____32.	Do	Job Sheet #2--Use Table-Mounted Holder to Dress a Grinding Wheel.

_____33.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21b, and proceed to Learning Step 35. Otherwise, repeat Learning Steps 30 through 32 and then continue to Learning Step 34.
_____34.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21b, and continue to Learning Step 35. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 21b, and continue to Learning Step 35.
_____35.	Refer	To Learning Step 21c. If this task has been initialed by your instructor, proceed to Learning Step 41. Otherwise, continue to Learning Step 36.
_____36.	Study	Job Sheet #3--Grind a Workpiece Straight and to Size, pages GM-289 through 292.
_____37.	Watch	Slide/tape presentation, "Grind a Workpiece Straight and to Size" (GM-III-3).
_____38.	Do	Job Sheet #3--Grind a Workpiece Straight and to Size.
_____39.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21c, and proceed to Learning Step 41. Otherwise, repeat Learning Steps 36 through 38 and continue to Learning Step 40.

_____40.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21c, and continue to Learning Step 41. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 21c, and continue to Learning Step 41.
_____41.	Refer	To Learning Step 21d. If this task has been initialed by your instructor, proceed to Learning Step 47. Otherwise, continue to Learning Step 42.
_____42.	Study	Job Sheet #4--Grind a Workpiece to Dimension, pages GM-293 through GM-297.
_____43.	Watch	Slide/tape presentation, "Grind a Workpiece to Dimension" (GM-III-4).
_____44.	Do	Job Sheet #4--Grind a Workpiece to Dimension.
_____45.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21d, and proceed to Learning Step 47. Otherwise, repeat Learning Steps 42 through 44 and then continue to Learning Step 46.
_____46.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21d, and continue to Learning Step 47. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 21d, and continue to Learning Step 47.

____47.	Refer	To Learning Step 21e. If this task has been initialed by your instructor, proceed to Learning Step 53. Otherwise, continue to Learning Step 48.
____48.	Study	Job Sheet #5--Grind a #4 Morse Taper, pages GM-299 through GM-303.
____49.	Watch	Slide/tape presentation, "Grind a #4 Morse Taper" (GM-III-5).
____50.	Do	Job Sheet #5--Grind a #4 Morse Taper.
____51.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21e, and proceed to Learning Step 53. Otherwise, repeat Learning Steps 48 through 50 and then continue to Learning Step 52.
____52.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21e, and continue to Learning Step 53. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 21e, and continue to Learning Step 53.
____53.	Refer	To Learning Step 21f. If this task has been initialed by your instructor, proceed to Learning Step 59. Otherwise, continue to Learning Step 54.
____54.	Study	Job Sheet #6--Grind an Internal Surface, pages GM-305 through 308.
____55.	Watch	Slide/tape presentation, "Grind an Internal Surface" (GM-III-6).

____56.	Do	Job Sheet #6--Grind an Internal Surface.
____57.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21f, and proceed to Learning Step 59. Otherwise, repeat Learning Steps 54 through 56 and then continue to Learning Step 58.
____58.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21f, and continue to Learning Step 59. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 21f, and continue to Learning Step 59.
____59.	Refer	To Learning Step 21g. If this task has been initialed by your instructor, proceed to Learning Step 66. Otherwise, continue to Learning Step 60.
____60.	Study	Job Sheet #7--Grind an Angular Surface, pages GM-309 and 310.
____61.	Watch	Slide/tape presentation, "Grind an Angular Surface" (GM-III-7).
____62.	Do	Job Sheet #7--Grind an Angular Surface.
____63.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21g, and proceed to Learning Step 65. Otherwise, repeat Learning Steps 60 through 62 and then continue to Learning Step 64.

_____64.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 21g, and continue to Learning Step 65. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 21g, and continue to Learning Step 65.
_____65.	Refer	To Learning Step 21. If all tasks have been initialed by your instructor, continue to Learning Step 66. Otherwise, refer to the Learning Step indicated in parentheses after the unsigned task.
_____66.	Review	Information Sheet (pages GM-243 through 258), Assignment Sheets, and LAP Assignment Sheets.
_____67.	Take	Cylindrical Grinding Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

PRETEST

NAME _____ SCORE _____

DIRECTIONS: The purpose of this pretest is to determine how much you already know about cylindrical grinding. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may prevent you from receiving needed instruction.

1. Match the following terms and definitions. Write the correct numbers in the blanks. Definitions are continued on the next page.

_____a.	Mechanical feed device that allows for adjustment of feed depth	1. Dwell or tarry time
_____ b.	Cylindrical grinder with headstock and workhead that can be swiveled; used to perform OD, ID and face grinding	2. Plain cylindrical grinder
_____ c.	Movement of table or workhead by hydraulic and/or mechanical feed	3. ID (inside diameter) grinding
_____ d.	Pause at one or both ends of table travel to permit grinding wheel to grind workpiece to size and to provide for completion of feed before table reverses direction	4. Work rotation
_____ e.	Rotation of workpiece at desired rate in opposite direction of grinding wheel	5. Live center
_____ f.	Center that revolves with workpiece	6. Feed index
_____ g.	Center that does not revolve	7. Dead center
_____ h.	Grinding on outside circumference of a round workpiece	8. Work feed
_____ i.	Cylindrical grinder designed especially for ID grinding	9. OD (outside diameter) grinding
_____ j.	Rate at which wheel is fed into workpiece each time table reverses	10. Wheel speed (rpm)
		11. Universal cylindrical grinder
		12. Automatic feed
		13. Work speed
		14. Internal cylindrical grinder

_____ k. Number of revolutions per minute (rpm) that grinding wheel turns

_____ l. Cylindrical grinder with headstock and workhead that are fixed; used to perform OD, straight, and taper grinding

_____ m. Number of revolutions per minute (rpm) that workpiece should turn to give correct surface speed and to obtain maximum wheel life, chip removal, and desired finish

_____ n. Grinding on inside of workpiece to enlarge a bore or hole

2. Match the following cylindrical grinding operations to their correct descriptions. Write the correct numbers in the blanks.

_____ a. Grinding a surface or shape by feeding wheel into workpiece with cross feed; can be performed on external or internal surfaces

_____ b. Grinding a conical surface that changes in diameter at a constant rate along its axis

_____ c. Grinding an angle by rotating workhead at desired angle to grinding wheel

_____ d. Grinding end of workpiece by rotating surface to be ground at a 90-degree angle to grinding wheel

_____ e. Grinding a hole or bore to an accurate size, taper, or finish

_____ f. Grinding a surface to a particular shape by means of a grinding wheel dressed to produce the desired shape

_____ g. Grinding a cylindrical surface to an accurate size and finish, with sides parallel to center axis throughout its length

_____ h. Grinding a surface 90 degrees to axis of workpiece

1. Plunge or infeed grinding
2. Angular grinding
3. Internal grinding
4. Taper grinding
5. Contour (form) grinding
6. Face grinding
7. Shoulder grinding
8. Straight grinding

3. Describe the procedures for removing and replacing a grinding wheel.

REMOVING WHEEL

MOUNTING WHEEL

4. Arrange in order steps for dressing the wheel for cylindrical grinding. Write a "1" before the first step, a "2" before the second step, and so on.

_____ a. Remove diamond and holder if required

_____ b. Start grinder, and allow spindle bearings to warm up

_____ c. Clamp diamond in holder

_____ d. Position diamond if holder is adjustable

_____ e. Stop wheel

_____ f. Position dresser so that it is clear of wheel

_____ g. Advance wheel 0.0005 inch for each pass across wheel, until face of wheel is completely dressed

_____ h. Turn on coolant if necessary

_____ i. Set table travel at 5 to 10 inches per minute (ipm), or set in truing position indicated by manufacturer

_____ j. Clean dust from tools and equipment

_____ k. Feed wheel so that diamond contacts point at largest diameter on grinding-wheel surface

5. Name five types of wheel dressers.

a. _____

b. _____

c. _____

d. _____

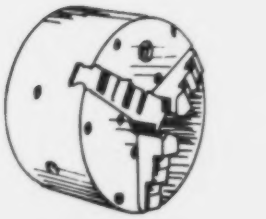
e. _____

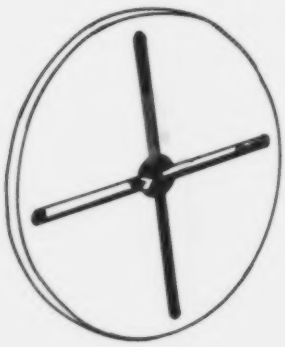
6. Identify the following illustrations of accessories used with cylindrical grinders. Write the correct names in the blanks.

Three-jaw chuck
Collet chuck
Magnetic chuck
Headstock and footstock centers
Universal backrest with adjustable shoe
Driving dogs
Center rest
Four-jaw chuck
T-slot faceplate

a. _____

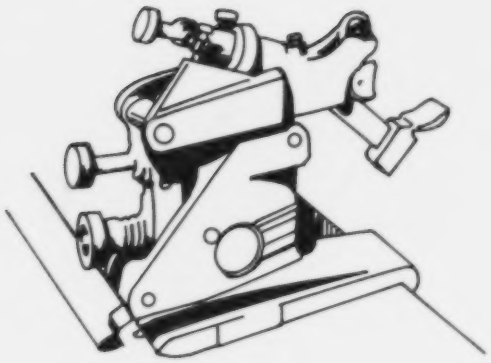
_____

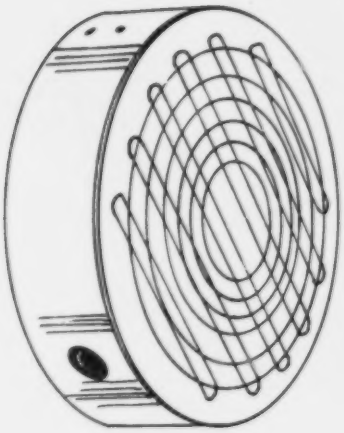




b. _____ c. _____

_____ _____



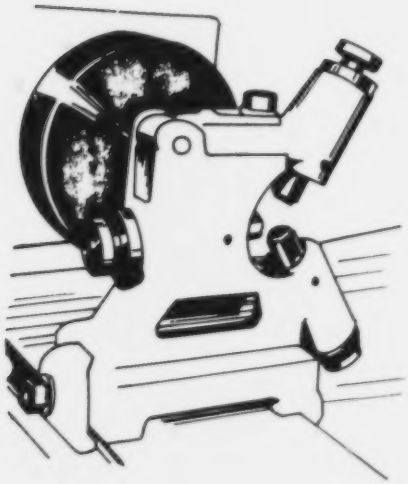


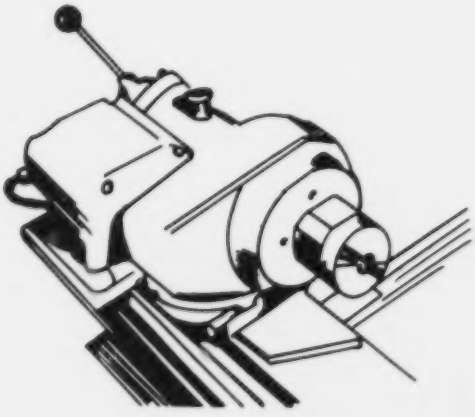
d. _____

_____

e. _____

_____



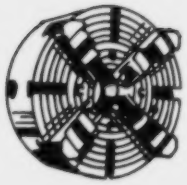


f. _____

_____

g. _____

_____



h. _____ i. _____

_____ _____

7. Match to their correct functions accessories used with cylindrical grinders. Write the correct numbers in the blanks.

_____ a.	Supporting long workpieces for external or internal grinding operations	1. Driving dogs
_____ b.	Supporting workpiece at each end for external grinding operations	2. Center rest
_____ c.	Holding and driving thin workpieces that cannot be chucked in a conventional chuck for face grinding	3. Magnetic chuck
_____ d.	Driving workpiece held between centers	4. Faceplate
_____ e.	Holding and driving workpieces for external grinding operations of small workpieces that do not vary in size; allows quick clamping	5. Chucks
_____ f.	Holding and driving workpieces for external or internal grinding operations that cannot be chucked; allows mounting of fixtures	6. Headstock and footstock centers
_____ g.	Supporting long workpieces so that accuracy can be maintained and chatter can be eliminated during grinding operation	7. Universal backrest with adjustable shoe
_____ h.	Holding and driving workpieces for external or internal grinding operations	8. Collet chuck

8. List probable causes for the following grinding problems.

CHATTER (list seven causes)

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

SCRATCHES ON FINISH (list four causes)

a. _____

b. _____

c. _____

d. _____

SPIRALS ON FINISH (list four causes)

a. _____

b. _____

c. _____

d. _____

WAVY LINES ON FINISH (list five causes)

a. _____

b. _____

c. _____

d. _____

e. _____

PRETEST

BURNT OR DISCOLORED FINISH (list seven causes)

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

FEED LINE ON FINISH (list four causes)

a. _____

b. _____

c. _____

d. _____

INACCURACIES IN WORKPIECE (list five causes)

a. _____

b. _____

c. _____

d. _____

e. _____

INTERMITTENT CUTTING ACTION (list four causes)

a. _____

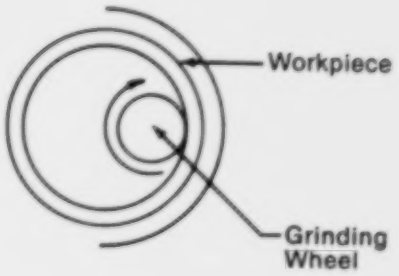
b. _____

c. _____

d. _____

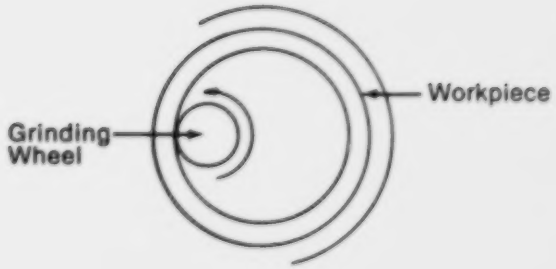
9. Determine work rotation with respect to wheel rotation by adding arrowheads to the arcs for the workpieces shown below.

a.



b.

c.



10. Calculate wheel speed (rpm), work speed, and rate of table travel (ipm) to do rough grinding on a 4-inch carbide shaft using a 3-inch wide, 10-inch diameter wheel and a surface speed of 6,000 sfpm.

(NOTE: For this pretest item, use a 2/3-inch or 0.67-inch wheel width in calculating rate of table travel, and use 50 fpm cutting speed. Show your work.)

a. Wheel speed = _____ rpm

b. Work speed = _____ rpm

c. Rate of table travel = _____ ipm

11. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

Refer to the Information Sheet, Sections(s)

_____ I	_____ VI
_____ II	_____ VII
_____ III	_____ VIII
_____ IV	_____ IX
_____ V	_____ X

You came here from Learning Step 2. If none of the above sections are checked, proceed to Learning Step 21. Otherwise, continue to Learning Step 3.

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Match the following terms and definitions. Write the correct numbers in the blanks. Definitions are continued on the next page.

_____ a.	Center that revolves with workpiece	1. Dead center
_____ b.	Grinding on inside of workpiece to enlarge a bore or hole	2. Work feed
_____ c.	Number of revolutions per minute (rpm) that grinding wheel turns	3. Dwell or tarry time
_____ d.	Cylindrical grinder with headstock and workhead that are fixed; used to perform OD, straight, and taper grinding	4. Plain cylindrical grinder
_____ e.	Number of revolutions per minute (rpm) that workpiece should turn to give correct surface speed and to obtain maximum wheel life, chip removal, and desired finish	5. ID (inside diameter) grinding
_____ f.	Mechanical feed device that allows for adjustment of feed depth	6. Work rotation
_____ g.	Cylindrical grinder with headstock and workhead that can be swiveled; used to perform OD, ID, and face grinding	7. Live center
_____ h.	Center that does not revolve	8. Feed index
_____ i.	Grinding on outside circumference of a round workpiece	9. OD (outside diameter) grinding
_____ j.	Cylindrical grinder designed especially for ID grinding	10. Universal cylindrical grinder
_____ k.	Movement of table or workhead by hydraulic and/or mechanical feed	11. Automatic feed
_____ l.	Pause at one or both ends of table travel to permit grinding wheel to grind workpiece to size and to provide for completion of feed before table reverses direction	12. Work speed
		13. Internal cylindrical grinder
		14. Wheel speed (rpm)

_____ m. Rate at which wheel is fed into workpiece each time table reverses

_____ n. Rotation of workpiece at desired rate in opposite direction of grinding wheel

2. Arrange in order the following procedures for removing and replacing a grinding wheel. Write a "1" before the first step, a "2" before the second step, and so on.

REMOVING WHEEL

_____ a. Remove puller, and slide sleeve from tapered spindle

_____ b. Use wheel-sleeve puller to loosen sleeve

_____ c. Take off spindle nut

_____ d. Use wrench to remove sleeve from wheel

_____ e. Store wheel if it is not damaged; otherwise, discard

_____ f. Remove outer portion of wheel guard

MOUNTING WHEEL

_____ a. Clean machine, and put away tools

_____ b. Replace wheel guard

_____ c. Stand to one side, jog start grinder, and allow wheel to reach operating speed and run for one minute

_____ d. Use wrench provided by manufacturer, or torque wrench, to tighten all screws snugly in an alternating sequence

_____ e. Slide wheel and blotters onto wheel sleeve

_____ f. Clean spindle and surface of fixed flange and/or wheel sleeve

_____ g. Check wheel balance; balance if necessary

_____ h. Place sleeve on spindle, and secure spindle nut

_____ i. Ring test the grinding wheel

_____ j. Place outer flange on sleeve, place screws in holes of outer flange, and finger-tighten all screws

3. Arrange in order the following steps for dressing a wheel for cylindrical grinding. Write a "1" before the first step, a "2" before the second step, and so on.

_____ a. Stop wheel

_____ b. Position dresser so that it is clear of wheel

_____ c. Advance wheel 0.0005 inch for each pass across wheel, until face of wheel is completely dressed

_____ d. Turn on coolant if necessary

_____ e. Set table travel at 5 to 10 inches per minute (ipm), or set in truing position indicated by manufacturer

_____ f. Clean dust from tools and equipment

_____ g. Remove diamond and holder if required

_____ h. Start grinder, and allow spindle bearings to warm up

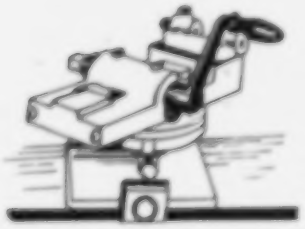
_____ i. Feed wheel so that diamond contacts point at largest diameter on grinding-wheel surface

_____ j. Clamp diamond in holder

_____ k. Position diamond if holder is adjustable

4. Identify the wheel dressers in the following illustrations. Write the correct names in the blanks.

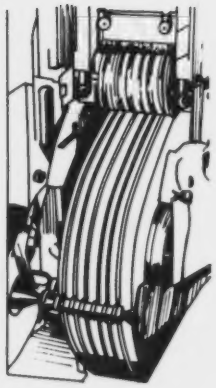
Table-mounted dresser
Footstock-mounted dresser
Crush roll dresser
Radius and tangent dresser
Angle dresser
Built-in dresser
Radius dresser



a. _____ b. _____

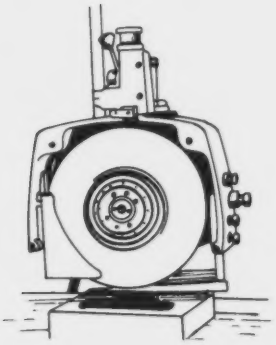
_____ _____

LAP ASSIGNMENT SHEET #1



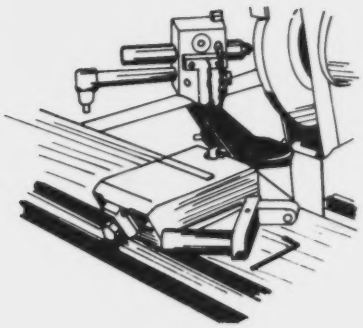
c. _____

_____



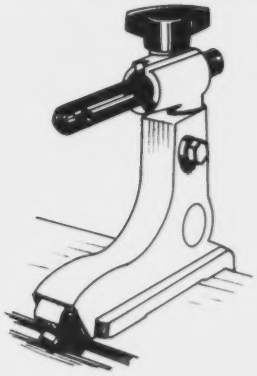
d. _____

_____



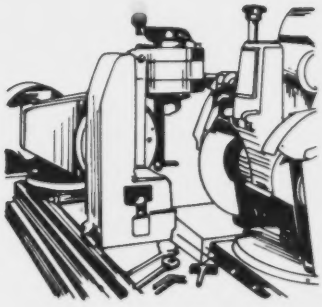
e. _____

_____



f. _____

_____



g. _____

_____

5. Identify the following illustrations of accessories used with cylindrical grinders. Write the correct names in the blanks.

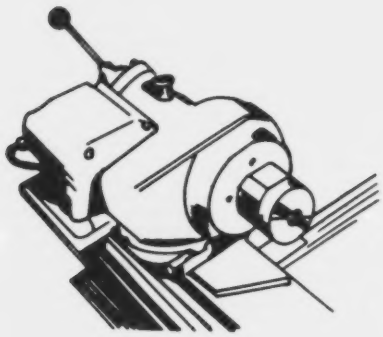
Headstock and footstock centers
Magnetic chuck
Driving dogs
Collet chuck
Universal backrest with adjustable shoe
T-slot faceplate
Center rest
Three-jaw chuck
Four-jaw chuck

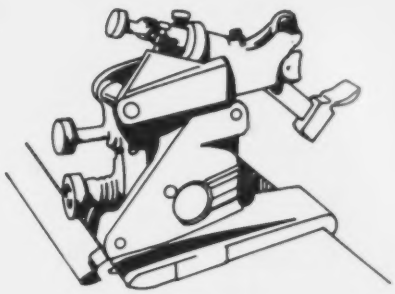
a. _____

_____

b. _____

_____





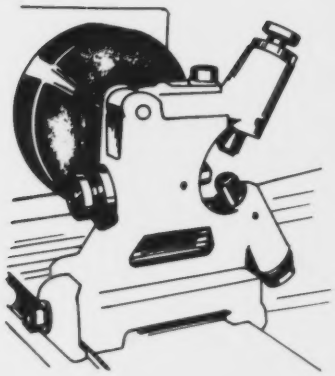
c. _____

_____

d. _____

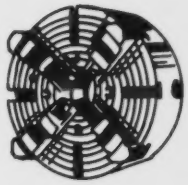
_____

LAP ASSIGNMENT SHEET #1



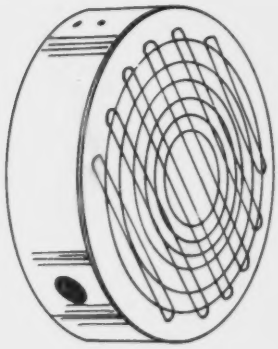
e. _____

_____



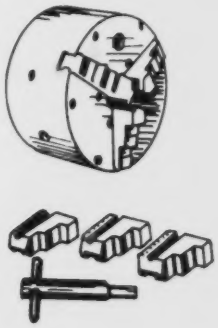
f. _____

_____



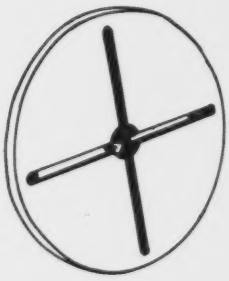
g. _____

_____



h. _____

_____



i. _____

_____

6. Match accessories used with cylindrical grinders to their correct functions. Write the correct numbers in the blanks.

_____	a.	Holding and driving thin workpieces that cannot be chucked in a conventional chuck for face grinding	1. Faceplate
_____	b.	Driving workpiece held between centers	2. Chucks
_____	c.	Holding and driving workpieces for external grinding operations of small workpieces that do not vary in size; allows quick clamping	3. Headstock and footstock centers
_____	d.	Supporting long workpieces for external or internal grinding operations	4. Driving dogs
_____	e.	Supporting workpiece at each end for external grinding operations	5. Center rest
_____	f.	Supporting long workpieces so that accuracy can be maintained and chatter can be eliminated during grinding operation	6. Magnetic chuck
_____	g.	Holding and driving workpieces for external or internal grinding operations	7. Collet chuck
_____	h.	Holding and driving workpieces for external or internal grinding operations that cannot be chucked; allows mounting of fixtures	8. Universal backrest with adjustable shoe

7. Select from the following lists probable causes of grinding problems. Write an "X" in the blank before each correct answer.

CHATTER

_____ a. Wheel out of round

_____ b. Work speed too low

_____ c. Centers worn or out of alignment

_____ d. Grinding wheel loose on sleeve

_____ e. Feed excessive

_____ f. Table travel too slow

_____ g. Wheel too hard

_____ h. Machine vibrating internally

_____ i. Machine improperly mounted or located

_____ j. Workpiece not supported properly

_____ k. Loose grain particles on wheel

SCRATCHES ON FINISH

_____ a. Coolant inadequate

_____ b. Table travel too fast

_____ c. Wheel too coarse

_____ d. Wheel too soft

_____ e. Wheel edge ragged

_____ f. Coolant dirty

_____ g. Wheel out of balance

SPIRALS ON FINISH

_____ a. Table travel too slow

_____ b. Loose grain particles on wheel

_____ c. Wheel edge ragged

_____ d. Coolant inadequate

_____ e. Workpiece center holes not true or clean

_____ f. Workpiece loose on centers

_____ g. Centers fitted poorly in spindles

_____ h. Wheel out of round

LAP ASSIGNMENT SHEET #1

WAVY LINES ON FINISH

_____ a. Workpiece too tight on centers

_____ b. Wheel edge ragged

_____ c. Machine vibrating externally

_____ d. Machine improperly mounted or located

_____ e. Grinding wheel material wrong

_____ f. Gear action faulty

_____ g. Wheel out of balance

_____ h. Centers worn or out of alignment

_____ i. Wheel out of round

BURNT OR DISCOLORED FINISH

_____ a. Coolant not properly directed

_____ b. Wheel too coarse

_____ c. Workpiece speed too low

_____ d. Wheel loaded or glazed

_____ e. Wheel speed too low

_____ f. Wheel too soft

_____ g. Coolant inadequate

_____ h. Wheel too hard

_____ i. Feed excessive

_____ j. Grinding wheel material wrong

_____ k. Table travel too fast

FEED LINE ON FINISH

_____ a. Grinding wheel material wrong

_____ b. Wheel loaded or glazed

_____ c. Workpiece too cold

_____ d. Workpiece not supported properly

_____ e. Wheel edge ragged

_____ f. Centers worn or out of alignment

_____ g. Coolant not properly directed

_____ h. Table travel incorrect

INACCURACIES IN WORKPIECE

_____ a. Gibs loose or table ways worn

_____ b. Workpiece center holes not true or clean

_____ c. Headstock or swivel table not properly aligned

_____ d. Wheel loaded or glazed

_____ e. Wheel out of round

_____ f. Centers fitted poorly in spindle

_____ g. Workpiece too cold

_____ h. Workpiece loose on centers

_____ i. Centers worn or out of alignment

_____ j. Table travel incorrect

_____ k. Workpiece too hot

INTERMITTENT CUTTING ACTION

_____ a. Workpiece too hot

_____ b. Wheel out of round

_____ c. Wheel loaded or glazed

_____ d. Wheel out of balance

_____ e. Table travel incorrect

_____ f. Workpiece too tight on centers

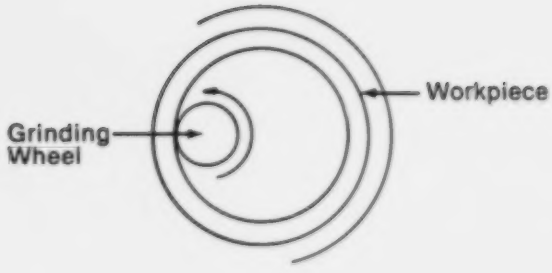
_____ g. Coolant not properly applied

_____ h. Workpiece out of balance

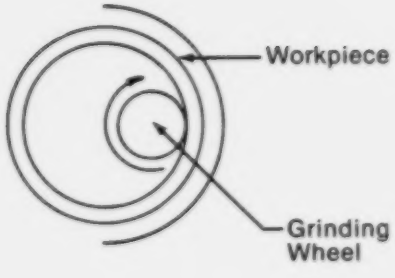
8. Determine work rotation with respect to wheel rotation by adding an arrowhead to the arcs for the workpieces shown below.

a.

b.



c.



9. Stop. Have your instructor evaluate your LAP Assignment Sheet and mark the area(s) below requiring additional study.

   Refer to Information Sheet, Section(s)

_____ I	_____ VI
_____ III	_____ VII
_____ IV	_____ VIII
_____ V	_____ IX

   If none of the above sections are checked, proceed to Learning Step 7. Otherwise, study the required section(s) and then continue to Learning Step 6.

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Write the missing words in the blanks to complete the following definitions associated with cylindrical grinding terms.

   a. WORK ROTATION--Rotation of workpiece at desired rate in _____ direction of grinding wheel

   b. WORK SPEED--Number of revolutions per minute (rpm) that workpiece should turn to give correct _____ _____ and to obtain maximum wheel life, chip removal, and desired finish

   c. WORK FEED--Rate at which wheel is fed into workpiece each time table _____

   d. WHEEL SPEED (rpm)--Number of revolutions per minute (rpm) that _____ _____ turns

   e. AUTOMATIC FEED--_____ of table or workhead by hydraulic and/or mechanical feed

   f. LIVE CENTER--Center that _____ with workpiece

   g. DEAD CENTER--Center that _____ _____ _____

   h. OD GRINDING--Grinding on _____ _____ of round workpiece

   i. ID GRINDING--Grinding on inside of workpiece to _____ a bore or hole

   j. PLAIN CYLINDRICAL GRINDER--Cylindrical grinder with headstock and workhead that are _____; used to perform OD, straight, and taper grinding

k. UNIVERSAL CYLINDRICAL GRINDER--Cylindrical grinder with headstock and workhead that can be _____; used to perform OD, ID, and face grinding

l. INTERNAL CYLINDRICAL GRINDER--Cylindrical grinder designed especially for _____ grinding

m. DWELL OR TARRY TIME--_____ at one or both ends of table travel to permit grinding wheel to grind workpiece to size and to provide for completion of feed before table reverses direction

n. FEED INDEX--Mechanical feed device that allows for adjustment of _____ _____

2. Fill in the missing words to complete the following procedures for removing and replacing a grinding wheel.

REMOVING WHEEL

a. Remove outer portion of _____ _____

b. Take off _____ _____

c. Use wheel-sleeve puller to _____ sleeve

d. Remove _____ and slide sleeve from tapered spindle

e. Use wrench to remove _____ from wheel

f. Store wheel if it is not damaged; otherwise, _____

MOUNTING WHEEL

a. _____ spindle and surface of fixed flange and/or wheel sleeve

b. _____ _____ the grinding wheel

c. Slide wheel and blotters onto wheel _____

d. Place _____ _____ on sleeve, place screws in holes of outer flange, and finger-tighten all screws

e. Use wrench provided by manufacturer, or torque wrench, to tighten all screws snugly in an _____ _____

f. Check _____ _____; balance if necessary

g. Place sleeve on _____, and secure spindle nut

h. Replace _____ _____

i. Stand to one side, jog start grinder, and allow wheel to reach operating speed and run for _____ _____

j. Clean _____, and put away tools

3. Fill in the missing words to complete the following steps for dressing a wheel for cylindrical grinding.

a. _____ diamond in holder

b. _____ _____ if holder is adjustable

c. _____ grinder, and allow spindle bearings to warm up

d. _____ wheel so that diamond contacts point at largest diameter on grinding-wheel surface

e. _____ table travel at 5 to 10 inches per minute (ipm), or set in truing position indicated by manufacturer

f. _____ _____ coolant if necessary

g. _____ _____ 0.0005 inch for each pass across wheel, until face of wheel is completely dressed

h. _____ _____ so that it is clear of wheel

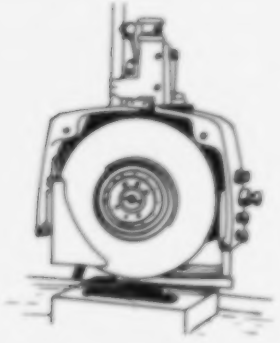
i. _____ wheel

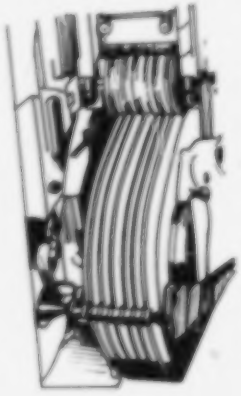
j. _____ diamond and holder if required

k. _____ dust from tools and equipment

LAP ASSIGNMENT SHEET #2

4. Identify the types of wheel dressers shown in the following illustrations. Write the correct names in the blanks.



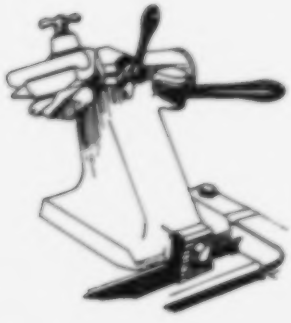


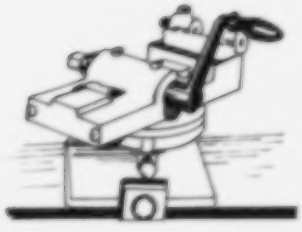
a. _____

_____

b. _____

_____





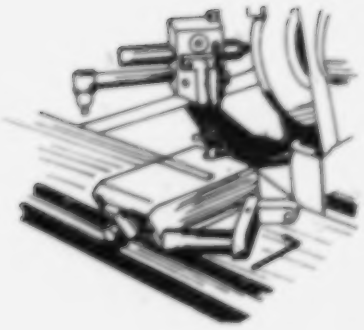
c. _____

_____

d. _____

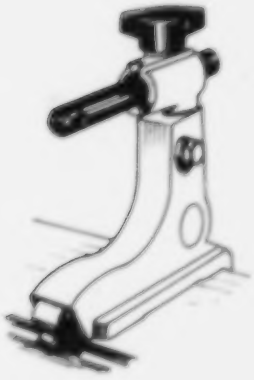
_____

LAP ASSIGNMENT SHEET #2



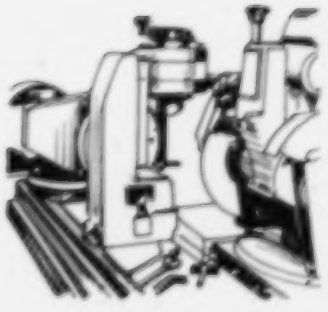
e. _____

_____



f. _____

_____

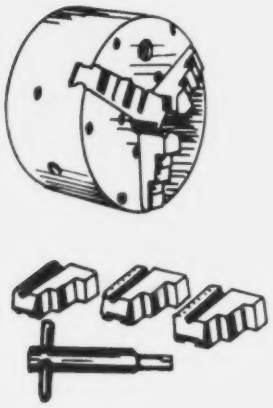


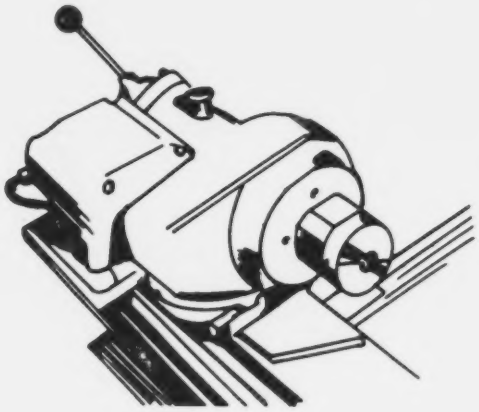
g. _____

_____

LAP ASSIGNMENT SHEET #2

5. Identify the following illustrations of accessories used with cylindrical grinders. Write the correct names in the blanks.



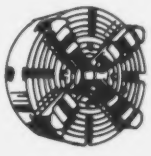


a. _____ b. _____

_____ _____

c. _____

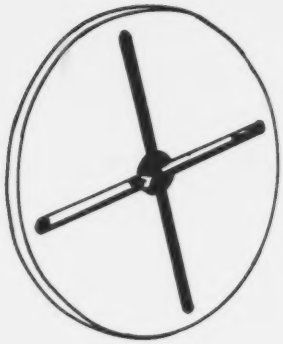
_____

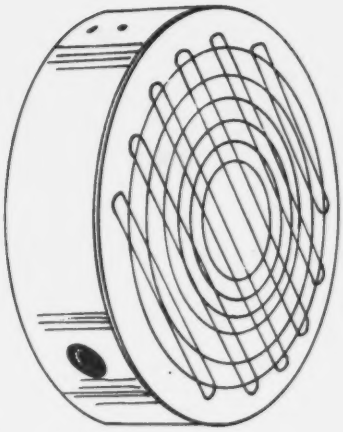


d. _____ e. _____

_____ _____

LAP ASSIGNMENT SHEET #2



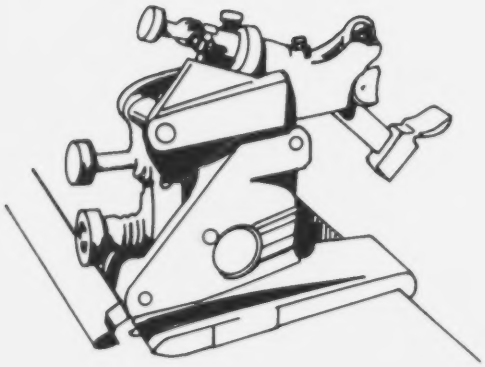


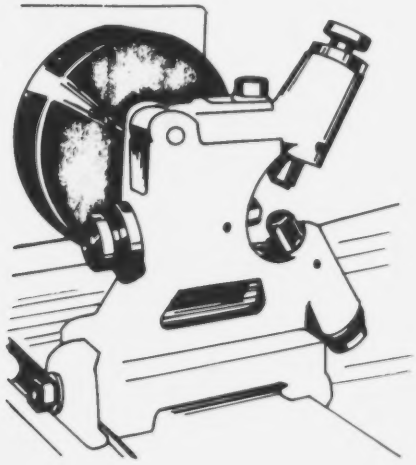
f. _____

_____

g. _____

_____





h. _____

_____

i. _____

_____

6. Match accessories used with cylindrical grinders to their correct functions. Write the correct numbers in the blanks.

_____ a. Supporting long workpieces for external or internal grinding operations	1.	Faceplate
_____ b. Supporting workpiece at each end for external grinding operations	2.	Driving dogs
_____ c. Holding and driving thin workpieces that cannot be chucked in a conventional chuck for face grinding	3.	Chucks
_____ d. Driving workpiece held between centers	4.	Universal backrest with adjustable shoe
_____ e. Holding and driving workpieces for external grinding operations of small workpieces that do not vary in size; allows quick clamping	5.	Collet chuck
_____ f. Holding and driving workpieces for external or internal grinding operations that cannot be chucked; allows mounting of fixtures	6.	Magnetic chuck
_____ g. Supporting long workpieces so that accuracy can be maintained and chatter can be eliminated during grinding operation	7.	Center rest
_____ h. Holding and driving workpieces for external or internal grinding operations	8.	Headstock and footstock centers

7. Fill in the missing words to complete probable causes for the following grinding problems.

CHATTER

a. Grinding wheel loose on _____

b. Wheel too _____

c. Wheel out of _____

d. Feed _____

e. Workpiece not _____ properly

f. Work speed too _____

g. Table travel too _____

h. Machine vibrating _____

i. Machine improperly mounted or _____

j. _____ worn or out of alignment

SCRATCHES ON FINISH

a. Coolant _____

b. Table travel too _____

c. Wheel too _____

d. Wheel too _____

e. Wheel edge _____

SPIRALS ON FINISH

a. Workpiece loose on _____

b. Workpiece center holes not _____ or _____

c. Centers fitted poorly in _____

d. Loose _____ _____ on wheel

e. Wheel edge _____

f. Table travel too _____

WAVY LINES ON FINISH

a. Wheel edge _____

b. Wheel out of _____

c. Wheel out of _____

d. Machine vibrating _____

e. Machine improperly _____ or located

f. _____ action faulty

g. Workpiece too _____ on centers

LAP ASSIGNMENT SHEET #2

BURNT OR DISCOLORED FINISH

a. Coolant _____

b. Coolant not properly _____

c. Wheel too _____

d. Wheel too _____

e. Grinding wheel material _____

f. Wheel loaded or _____

g. Wheel speed too _____

h. Workpiece speed too _____

i. Table travel too _____

j. Feed _____

FEED LINE ON FINISH

a. Grinding wheel _____ wrong

b. Wheel edge _____

c. Workpiece not _____ properly

d. Centers _____ or out of alignment

e. Coolant not properly _____

f. Table travel _____

INACCURACIES IN WORKPIECE

a. Centers worn or out of _____

b. Centers fitted poorly in _____

c. _____ loose or table ways worn

d. Headstock or _____ table not properly aligned

e. Workpiece _____ on centers

f. Workpiece center holes not _____ or clean

g. Workpiece too _____

h. Wheel _____ or _____

LAP ASSIGNMENT SHEET #2

INTERMITTENT CUTTING ACTION

a. Workpiece too _____ on centers

b. Workpiece too _____

c. Workpiece out of _____

d. Wheel out of _____

e. Wheel out of _____

f. Coolant not properly _____

8. Choose the best answer to complete the following statements about work and wheel rotation. Write the correct numbers in the blanks.

_____ a. Grinders may operate so that the wheel and workpiece rotate

1) In the same direction
2) In opposite directions
3) In the same or opposite directions

_____ b. At the point of contact, the surfaces rotate

1) In the same direction
2) In opposite direction
3) In the same or opposite directions

9. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

LAP ASSIGNMENT SHEET #3

NAME _____ SCORE _____

1. Identify the following cylindrical grinding operations. Write the correct names in the blanks.

Straight grinding	Contour (form) grinding
Plunge or infeed grinding	Internal grinding
Face grinding	Shoulder grinding
Taper grinding	Angular grinding

_____ a. Grinding a surface or shape by feeding wheel into workpiece with cross feed; can be performed on external or internal surfaces

_____ b. Grinding a conical surface that changes in diameter at a constant rate along its axis

_____ c. Grinding an angle by rotating workhead at desired angle to grinding wheel

_____ d. Grinding end of workpiece by rotating surface to be ground at a 90-degree angle to grinding wheel

_____ e. Grinding a hole or bore to an accurate size, taper, or finish

_____ f. Grinding a surface to a particular shape by means of a grinding wheel dressed to produce the desired shape

_____ g. Grinding a cylindrical surface to an accurate size and finish, with sides parallel to center axis throughout its length

_____ h. Grinding a surface 90 degrees to axis of workpiece

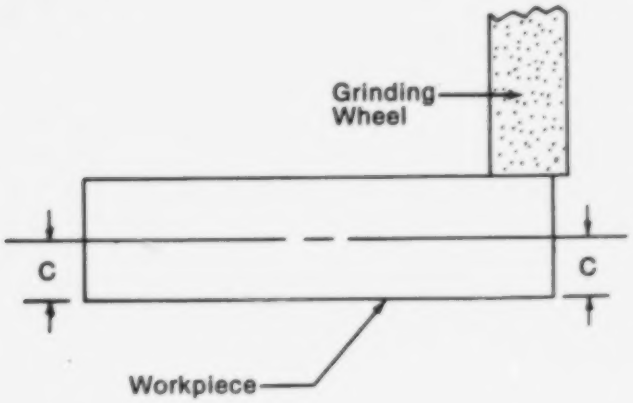
2. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 3. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 3.

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

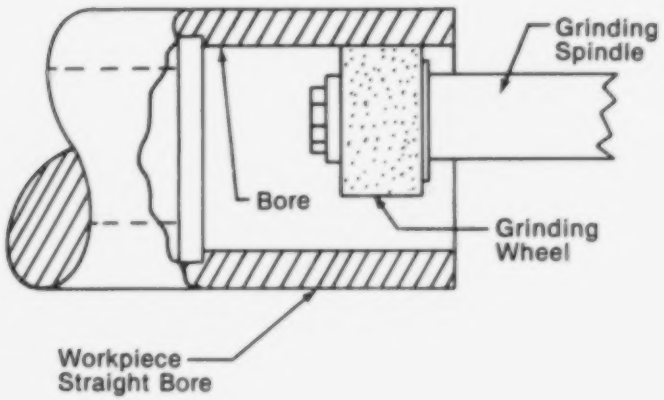
LAP ASSIGNMENT SHEET #4

NAME _____ SCORE _____

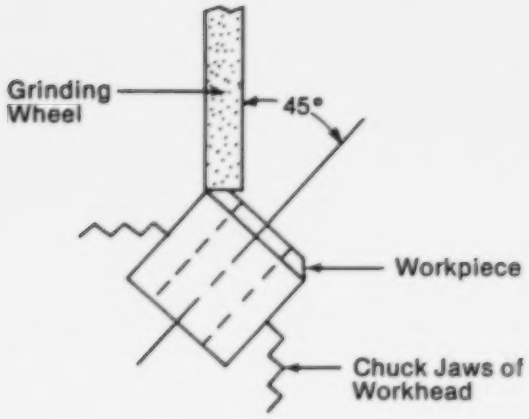
1. Identify the following cylindrical grinding operations by writing the correct names in the blanks.



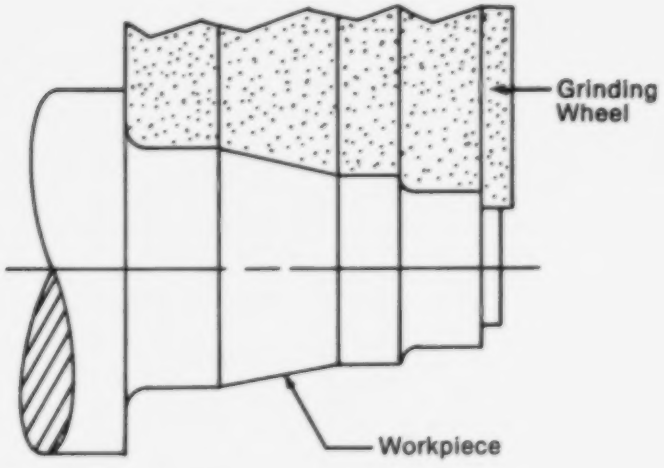
a. _____



b. _____

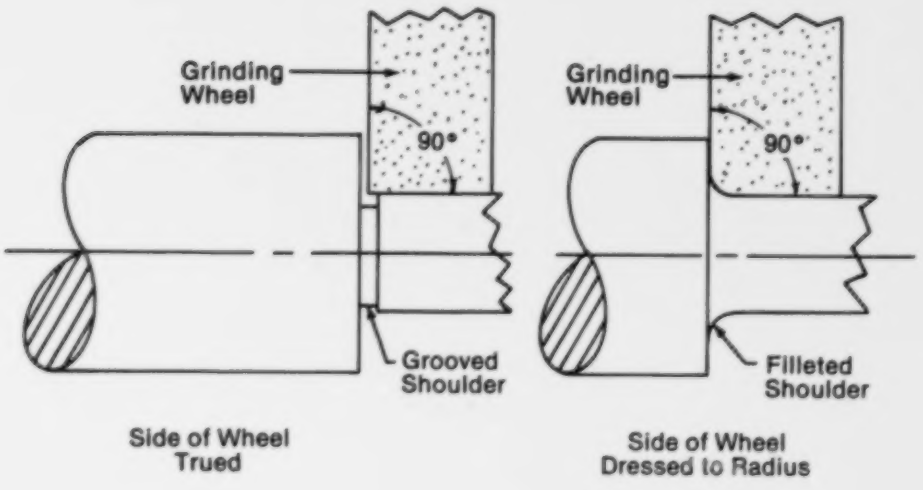

Grinding Wheel
45°
Workpiece
Chuck Jaws of Workhead

c. _____

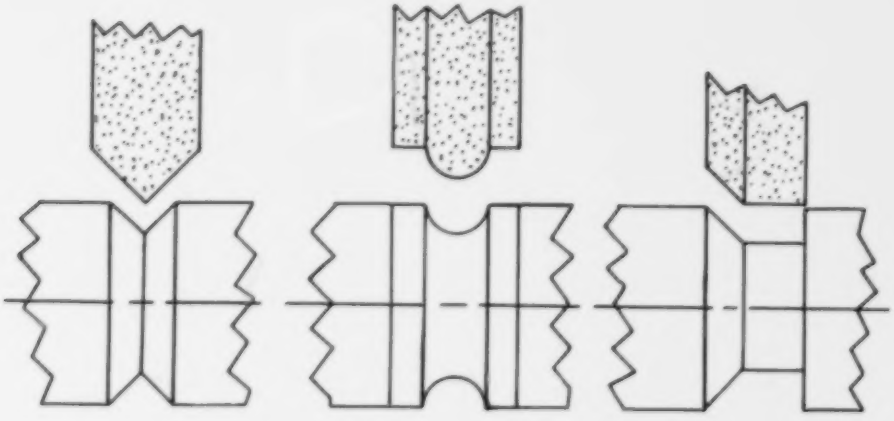

Grinding Wheel
Workpiece

d. _____

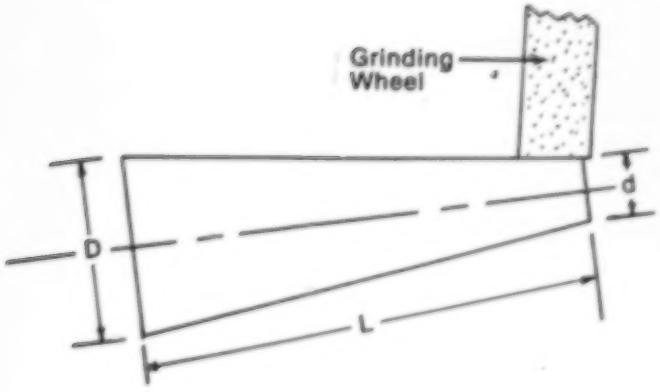
LAP ASSIGNMENT SHEET #4



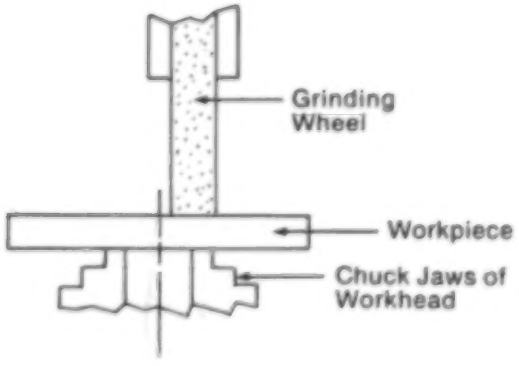
e. _____



f. _____



g. _____



h. _____

2. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 14. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 14.

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

LAP ASSIGNMENT SHEET #5

NAME _____ SCORE _____

1. Answer the following questions about cylindrical grinding operations.

   a. What is the difference between straight grinding and plunge or infeed grinding?

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   b. How does contour grinding produce the desired shape?

   _____

   _____

   _____

   c. In angular grinding, what is rotated to produce the desired angle?

   _____

2. Write an "X" before the grinding operation in which the surface is ground 90 degrees to the axis of the workpiece.

   _____ a. Angular grinding

   _____ b. Shoulder grinding

   _____ c. Face grinding

LAP ASSIGNMENT SHEET #5

3. Write an "X" before the grinding operation in which the end of the workpiece is ground by rotating the surface at a 90-degree angle to the grinding wheel.

   _____ a. Angular grinding

   _____ b. Shoulder grinding

   _____ c. Face grinding

4. List the specifications to which internal grinding can grind a hole or a bore.

   a. _____

   b. _____

   c. _____

5. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 17. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 17.

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

LAP ASSIGNMENT SHEET #6

NAME _____ SCORE _____

1. Write the formula for calculating wheel speed.

   Wheel speed (rpm) = _____

   _____

2. Write the formula for calculating work speed.

   Work speed = _____

   _____

3. Write the formula for calculating rate of table travel.

   Rate of table travel = _____

   _____

4. Calculate wheel speed, work speed, and rate of table travel for each of the following grinding problems. Use cutting speeds of 50 fpm for external grinding and 100 fpm for internal grinding. For calculating rate of table travel, use 0.67 of wheel width to figure rough grinding, and 0.25 inch to figure finish grinding. Show your work.

   a. Rough grind a 3-inch diameter hardened steel shaft using a 2-inch wide wheel with a 12-inch diameter. Surface speed is 5,500 sfpm.

      Wheel speed = _____ rpm

      Work speed = _____ rpm

      Rate of table travel = _____ ipm

b. Finish grind a 2.5-inch bore in a plate 14 inches in diameter. You will use a 10-inch wheel, 1 inch wide; and the surface speed will be 6,500 sfpm.

Wheel speed = _____ rpm

Work speed = _____ rpm

Rate of table travel = _____ ipm

c. Grind the surface of a steel shaft 6 inches in diameter, using a 15-inch grinding wheel, 3.5 inches wide. Surface speed will be 6,000 sfpm.

Wheel speed = _____ rpm

Work speed = _____ rpm

Rate of table travel for rough grinding = _____ ipm

Rate of table travel for finish grinding= _____ ipm

5. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 21. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 21.

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

ANSWERS TO PRETEST

1. a. 6
   b. 11
   c. 12
   d. 1
   e. 4
   f. 5
   g. 7
   h. 9
   i. 14
   j. 8
   k. 10
   l. 2
   m. 13
   n. 3

2. a. 1
   b. 4
   c. 2
   d. 6
   e. 3
   f. 5
   g. 8
   h. 7

3. Description should include the following

   REMOVING WHEEL

   a. Remove outer portion of wheel guard
   b. Take off spindle nut
   c. Use wheel-sleeve puller to loosen sleeve
   d. Remove puller, and slide sleeve from tapered spindle
   e. Use wrench to remove sleeve from wheel
   f. Store wheel if it is not damaged; otherwise, discard

   MOUNTING WHEEL

   a. Clean spindle and surface of fixed flange and/or wheel sleeve
   b. Ring test the grinding wheel
   c. Slide wheel and blotters onto wheel sleeve

d. Place outer flange on sleeve, place screws in holes of outer flange, and finger-tighten all screws

e. Use wrench provided by manufacturer, or torque wrench, to tighten all screws snugly in an alternating sequence

f. Check wheel balance; balance if necessary

g. Place sleeve on spindle, and secure spindle nut

h. Replace wheel guard

i. Stand to one side, jog start grinder, and allow wheel to reach operating speed and run for one minute

j. Clean machine, and put away tools

4.

a.	10	d.	2	g.	7	j.	11
b.	3	e.	9	h.	6	k.	4
c.	1	f.	8	i.	5		

5. Answer should include any five of the following

a. Footstock-mounted dresser
b. Table-mounted dresser
c. Radius dresser
d. Angle dresser
e. Radius and tangent dresser
f. Crush roll dresser
g. Built-in dresser

6.

a. Headstock and footstock centers
b. Three-jaw chuck
c. T-slot faceplate
d. Universal backrest with adjustable shoe
e. Magnetic chuck
f. Center rest
g. Collet chuck
h. Driving dogs
i. Four-jaw chuck

ANSWERS TO PRETEST

7. a. 2
   b. 6
   c. 3
   d. 1
   e. 8
   f. 4
   g. 7
   h. 5

8. CHATTER (answer should include any seven of the following)
   a. Grinding wheel loose on sleeve
   b. Wheel too hard
   c. Wheel out of round
   d. Feed excessive
   e. Workpiece not supported properly
   f. Work speed too high
   g. Table travel too fast
   h. Machine vibrating internally
   i. Machine improperly mounted or located
   j. Centers worn or out of alignment

   SCRATCHES ON FINISH (answer should include any four of the following)
   a. Coolant dirty
   b. Table travel too fast
   c. Wheel too soft
   d. Wheel too coarse
   e. Wheel edge ragged

   SPIRALS ON FINISH (answer should include any four of the following)
   a. Workpiece loose on centers
   b. Workpiece center holes not true or clean
   c. Centers fitted poorly on spindles
   d. Loose grain particles on wheel

e. Table travel too fast

WAVY LINES ON FINISH (answer should include any five of the following)

a. Wheel edge ragged

b. Wheel out of balance

c. Wheel out of round

d. Machine vibrating internally

e. Machine improperly mounted or located

f. Gear action faulty

g. Workpiece too tight on centers

BURNT OR DISCOLORED FINISH (answer should include any seven of the following)

a. Coolant inadequate

b. Coolant not properly directed

c. Wheel too hard

d. Wheel too fine

e. Grinding wheel material wrong

f. Wheel loaded or glazed

g. Wheel speed too high

h. Workpiece speed too low

i. Table travel too fast

j. Feed excessive

FEED LINE ON FINISH (answer should include any four of the following)

a. Grinding wheel material wrong

b. Wheel edge ragged

c. Workpiece not supported properly

d. Centers worn or out of alignment

e. Coolant not properly directed

f. Table travel incorrect

ANSWERS TO PRETEST

INACCURACIES IN WORKPIECE (answer should include any five of the following)

a. Centers worn or out of alignment

b. Centers fitted poorly in spindle

c. Gibs loose or table ways worn

d. Headstock or swivel table not properly aligned

e. Workpiece loose on centers

f. Workpiece center holes not true or clean

g. Workpiece too hot

h. Wheel loaded or glazed

INTERMITTENT CUTTING ACTION (answer should include any four of the following)

a. Workpiece too tight on centers

b. Workpiece too hot

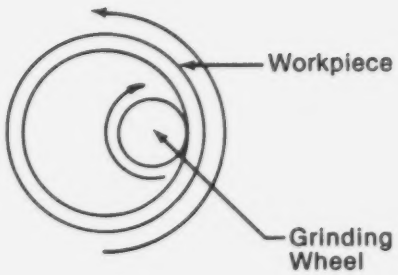
c. Workpiece out of balance

d. Wheel out of balance

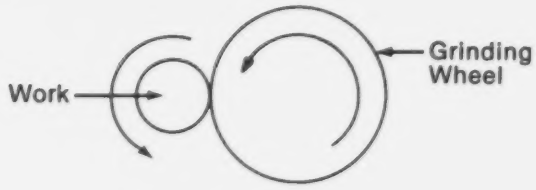
e. Wheel out of round

f. Coolant not properly applied

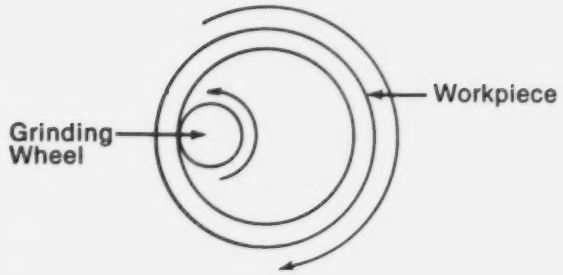
9. a.



b.



c.



10. a. 2,280 rpm

    b. 50 rpm

    c. 100 or 100.5 ipm

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

ANSWERS TO LAP ASSIGNMENT SHEET #1

1. a. 7
   b. 5
   c. 14
   d. 4
   e. 12
   f. 8
   g. 10
   h. 1
   i. 9
   j. 13
   k. 11
   l. 3
   m. 2
   n. 6

2. REMOVING WHEEL
   a. 4
   b. 3
   c. 2
   d. 5
   e. 6
   f. 1

   MOUNTING WHEEL
   a. 10
   b. 8
   c. 9
   d. 5
   e. 3
   f. 1
   g. 6
   h. 7
   i. 2
   j. 4

3. a. 9
   b. 8
   c. 7
   d. 6
   e. 5
   f. 11
   g. 10
   h. 3
   i. 4
   j. 1
   k. 2

ANSWERS TO LAP ASSIGNMENT SHEET #1

4. a. Angle dresser
   b. Footstock-mounted dresser
   c. Crush roll dresser
   d. Built-in dresser
   e. Radius dresser
   f. Table-mounted dresser
   g. Radius and tangent dresser

5. a. Headstock and footstock centers
   b. Driving dogs
   c. Collet chuck
   d. Universal backrest with adjustable shoe
   e. Center rest
   f. Four-jaw chuck
   g. Magnetic chuck
   h. Three-jaw chuck
   i. T-slot faceplate

6. a. 6
   b. 4
   c. 7
   d. 5
   e. 3
   f. 8
   g. 2
   h. 1

7. CHATTER

   a, c, d, e, g, h, i, j

   SCRATCHES ON FINISH

   b, c, d, e, f

ANSWERS TO LAP ASSIGNMENT SHEET #1

SPIRALS ON FINISH

b, c, e, f, g

WAVY LINES ON FINISH

a, b, d, f, g, i

BURNT OR DISCOLORED FINISH

a, c, d, g, h, i, j, k

FEED LINE ON FINISH

a, d, e, f, g, h

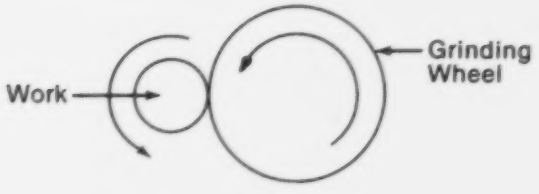
INACCURACIES IN WORKPIECE

a, b, c, d, f, h, i, k

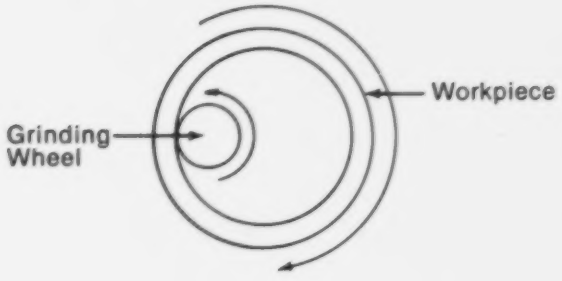
INTERMITTENT CUTTING ACTION

a, b, d, f, g, h

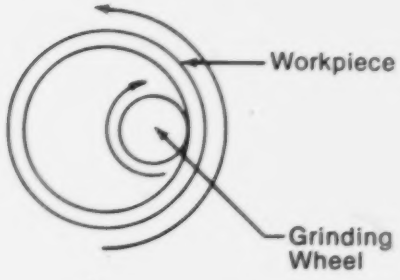
8. a.



b.



c.



GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

ANSWERS TO LAP ASSIGNMENT SHEET #2

1. a. Opposite
   b. Surface speed
   c. Reverses
   d. Grinding wheel
   e. Movement
   f. Revolves
   g. Does not revolve
   h. Outside circumference
   i. Enlarge
   j. Fixed
   k. Swiveled
   l. ID or inside diameter
   m. Pause
   n. Feed depth

2. REMOVING WHEEL
   a. Wheel guard
   b. Spindle nut
   c. Loosen
   d. Puller
   e. Sleeve
   f. Discard

   MOUNTING WHEEL
   a. Clean
   b. Ring test
   c. Sleeve
   d. Outer flange
   e. Alternating sequence
   f. Wheel balance
   g. Spindle
   h. Wheel guard
   i. One minute
   j. Machine

3. a. Clamp
   b. Position diamond
   c. Start
   d. Feed
   e. Set
   f. Turn on
   g. Advance wheel
   h. Position dresser
   i. Stop
   j. Remove
   k. Clean

ANSWERS TO LAP ASSIGNMENT SHEET #2

4. a. Built-in dresser
   b. Crush roll dresser
   c. Footstock-mounted dresser
   d. Angle dresser
   e. Radius dresser
   f. Table-mounted dresser
   g. Radius and tangent dresser

5. a. Three-jaw chuck
   b. Collet chuck
   c. Headstock and footstock centers
   d. Driving dogs
   e. Four-jaw chuck
   f. T-slot faceplate
   g. Magnetic chuck
   h. Universal backrest with adjustable shoe
   i. Center rest

6. a. 7
   b. 8
   c. 6
   d. 2
   e. 5
   f. 1
   g. 4
   h. 3

7. CHATTER

   a. Sleeve
   b. Hard
   c. Round
   d. Excessive
   e. Supported
   f. High
   g. Fast
   h. Internally
   i. Located
   j. Centers

ANSWERS TO LAP ASSIGNMENT SHEET #2

SCRATCHES ON FINISH

a. Dirty
b. Fast
c. Soft
d. Coarse
e. Ragged

SPIRALS ON FINISH

a. Centers
b. True, clean
c. Spindles
d. Grain particles
e. Ragged
f. Fast

WAVY LINES ON FINISH

a. Ragged
b. Balance
c. Round
d. Internally
e. Mounted
f. Gear
g. Tight

BURNT OR DISCOLORED FINISH

a. Inadequate
b. Directed
c. Hard
d. Fine
e. Wrong
f. Glazed
g. High
h. Low
i. Fast
j. Excessive

FEED LINE ON FINISH

a. Material
b. Ragged
c. Supported
d. Worn
e. Directed
f. Incorrect

INACCURACIES IN WORKPIECE

a. Alignment
b. Spindle
c. Gibs
d. Swivel
e. Loose
f. True
g. Hot
h. Loaded, glazed

INTERMITTENT CUTTING ACTION

a. Tight
b. Hot
c. Balance
d. Balance
e. Round
f. Applied

8. a. 3

b. 2

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

ANSWERS TO LAP ASSIGNMENT SHEET #3

1. a. Plunge or infeed grinding

   b. Taper grinding

   c. Angular grinding

   d. Face grinding

   e. Internal grinding

   f. Contour (form) grinding

   g. Straight grinding

   h. Shoulder grinding

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

ANSWERS TO LAP ASSIGNMENT SHEET #4

1. a. Straight grinding

   b. Internal grinding

   c. Angular grinding

   d. Contour (form) grinding

   e. Shoulder grinding

   f. Plunge or infeed grinding

   g. Taper grinding

   h. Face grinding

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

ANSWERS TO LAP ASSIGNMENT SHEET #5

1. Answers should include the following

   a. Straight grinding is done with side parallel to center axis through the length of the workpiece; plunge or infeed grinding is done by feeding wheel into workpiece with cross feed. Straight grinding is surface grinding only; plunge or infeed grinding can be performed on internal or external surfaces.

   b. The grinding wheel is dressed to produce the desired shape.

   c. Workhead

2. b

3. c

4. a. Accurate size

   b. Taper

   c. Finish

GRINDING MACHINES
UNIT III--CYLINDRICAL GRINDING

ANSWERS TO LAP ASSIGNMENT SHEET #6

1. $\frac{\text{Wheel Speed (sfpm) x 3.8}}{\text{Wheel Diameter (D)}}$

2. $\frac{\text{Cutting Speed (CS) x 4}}{\text{Workpiece Diameter (D)}}$

3. Work Speed x Table Travel per Revolution

   (Answer may also include the following: For rough grinding, set table travel at 1/2 to 2/3 the wheel width per revolution of workpiece; for finish grinding, set table travel at 1/8 to 1/2 inch per revolution of workpiece.)

4. a. Wheel speed = 1,741.67 rpm

   Work speed = 66.7 rpm

   Rate of table travel = 89.4 ipm

   b. Wheel speed = 2,470 rpm

   Work speed = 160 rpm

   Rate of table travel = 40 ipm

   c. Wheel speed = 1,520 rpm

   Work speed = 33.3 rpm

   Rate of table travel for rough grinding = 78 ipm

   Rate of table travel for finish grinding = 8.3 ipm